IFW / AF $

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 500.00

Complete if Known	
Application Number	10/725,769
Filing Date	December 2, 2003
First Named Inventor	Lindsay et al.
Examiner Name	B. Livedalen
Art Unit	2878
Attorney Docket No.	40518.112/10060298-2

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____________

☐ Deposit Account Deposit Account Number: ____________ Deposit Account Name: ____________

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent	50	25
Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent	200	100
Multiple dependent claims	360	180

Total Claims ____ - 20 or HP = **Extra Claims** ____ x **Fee ($)** ____ = **Fee Paid ($)** ____

HP = highest number of total claims paid for, if greater than 20

Indep. Claims ____ - 3 or HP = **Extra Claims** ____ x **Fee ($)** ____ = **Fee Paid ($)** ____

HP = highest number of independent claims paid for, if greater than 3

Multiple Dependent Claims **Fee ($)** ____ **Fee Paid ($)** ____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = **Extra Sheets** ____ / 50 = **Number of each additional 50 or fraction thereof** ____ (round **up** to a whole number) x **Fee ($)** ____ = **Fee Paid ($)** ____

4. OTHER FEE(S) **Fees Paid ($)**

Non-English Specification, $130 fee (no small entity discount) ____

Other: Brief on Appeal $500.00

SUBMITTED BY				
Signature	/Timothy W. Hagan/	Registration No. (Attorney/Agent)	29,001	Telephone (937) 449-6400
Name (Print/Type)	Timothy W. Hagan			Date June 21, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application of

Applicants	: Stuart Lindsay and Tianwei Jing
Serial No.	: 10/725,769
Filed	: December 2, 2003
Title	: **FAST SCANNING STAGE FOR A SCANNING PROBE MICROSCOPE**
Docket	: 40518.112/10060298-2
Examiner	: B. Livedalen
Art Unit	: 2878
Conf. No.	: 3836

CERTIFICATE OF MAILING
I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on June 21, 2006.

Attorney **Reg. No. 29,001**

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

BRIEF ON APPEAL

This is an appeal from the Office Action mailed December 22, 2005, finally rejecting claims 1-13 and 15, all of the claims presently pending in this application. A Notice of Appeal was timely mailed on April 21, 2006, with the accompanying fee, along with a request for an extension of time. Our check in the amount of $500.00 accompanies this Brief in accordance with 37 CFR §41.20(b)(2).

Real Party in Interest

The real parties in interest in this application are Molecular Imaging Corporation (1/2 interest) and Arizona Board of Regents (1/2 interest) by an assignment which is recorded in the files of the U.S. Patent and Trademark Office at Reel 014894, Frame 0004, on January 20, 2004.

06/27/2006 YPOLITE1 00000071 10725769
01 FC:1402 500.00 OP

Related Appeals and Interferences

Applicants know of no other related appeal or interference that will directly or indirectly affect or have a bearing on the outcome of this appeal.

Status of Claims

Claims 1-13 and 15 are pending in this application; claim 14 was previously canceled. Claims 1-13 and 15 stand finally rejected and are before this Board for consideration on appeal. A copy of the appealed claims is found in the Appendix attached to this brief.

Status of Amendments

All of the amendments previously filed in this application have been entered. A Request for Reconsideration was filed on March 22, 2006, but did not result in the allowance of any claims.

Summary of the Claimed Subject Matter

The invention in general relates to scanning probe microscopy such as, for example, atomic force microscopy or near-field optical microscopy. Preferred embodiments of applicants' invention are directed to a fast scanning stage for a scanning probe microscope and a method of operating such a fast scanning stage. The stage permits acquisition of images at an improved rate in comparison to conventional scanning probe microscopes.

As described in applicants' specification at page 7, paragraph [0024] and depicted in Figs. 2A and 2B, the scanning probe microscope includes a scanning probe **24**, and the scanning stage **21** comprises at least one fixed support **23** (two shown) and a sample stage **21** having at least one axis of translation. As further described the sample stage **21** is affixed to the at least one fixed support **23** by means for causing displacement of the stage relative to the probe. Thus, in the embodiment shown in Figs. 2A and 2B, sample stage **21** is fixed to supports **23** by four actuators **22**. Likewise, in the embodiment shown in Figs. 5A and 5B, sample stage **21** is fixed to rigid frame (support element) **51** by actuators **22**. As shown in this embodiment, the actuators are driven in phase, and actuator motion is transverse to the axis of the actuator.

In a preferred form as depicted in Figs. 2A and 2B, the means for causing relative displacement comprises at least one, and most preferably four, actuator elements **22** that are

attached to the sample stage through the fixed support. The actuator element or elements are preferably driven at the resonant frequency of the sample stage to permit fast line scans at a rate of several kHz which are free from turn around artifacts. This can be seen by comparing the "ringing" motion of prior art devices (see, Fig. 1D and page 3, paragraphs [0009] and [0010]) with the motion of applicants' scanning stage (see, Figs. 3A and 3B and page 8, paragraph [0026]).

Grounds of Rejection to be Reviewed on Appeal

The grounds of rejection for review by this Board are:

(1) Claims 1 and 12 stand rejected under 35 USC §102 as anticipated by Sarkar et al (US 6,806,991);

(2) Claims 2-6 and 13 stand rejected under 35 USC §103 as unpatentable over Sarkar et al in view of Flecha et al (US 5,773,824);

(3) Claims 4 and 13 stand rejected under 35 USC §103 as unpatentable over Sarkar et al in view of Flecha and Okiguchi (JP 09054097);

(4). Claim 7 stands rejected under 35 USC §103 as unpatentable over Sarkar in view of Flecha and Pai (US 6,338,249);

(5) Claim 8 stands rejected under 35 USC §103 as unpatentable over Sarkar in view of Flecha and Elings (US RE 37,560);

(6) Claims 9 and 10 stand rejected under 35 USC §103 as unpatentable over Sarkar in view of Flecha and Zdeblick (US 4,906,840);

(7) Claim 11 stands rejected under 35 USC §103 as unpatentable over Sarkar in view of Marchman (US 5,811,796); and

(8) Claim 15 stands rejected under 35 USC §103 as unpatentable over Sarkar in view of Flecha, Okiguchi, and Ando et al.

Argument

Applicants submit that the rejections are not well taken in that: clear errors of fact have been made; clear deficiencies in the references omit one or more essential elements of the

claimed invention needed to establish a prima facie case; and, clear deficiencies exist in the record with respect to motivation or suggestion to combine the reference teachings.

A. The Rejection of Claims 1 and 12 under 35 USC § 102 as Anticipated by Sarkar et al

For this ground of rejection, both of claims 1 and 12 are independent. Applicants will separately argue the patentability of each claim.

Claim 1

1. The Examiner failed to carry his burden of establishing that each and every limitation recited in the claim is found in a single prior art reference.

Anticipation under 35 USC §102(b) requires the disclosure in a single prior art reference of each element of the claims under consideration. *Alco Standard Corp. v. TVA*, 1 USPQ2d 1337, 1341 (Fed. Cir. 1986). The corollary of the rule is that absence from the reference of any claimed element negates anticipation. *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 230 USPQ 81 (Fed. Cir. 1986).

2. Sarkar does not teach a sample stage that is affixed to at least one fixed support by means for causing displacement of the stage relative to the probe.

Sarkar relates to a "fully released" microstage that includes a "payload structure" such as a lens, mirror, or manipulator. The microstage is moved using actuators that are coupled to flexure elements. As shown in the embodiment in Fig. 2, Sarkar requires multiple actuators 203a-d coupled to sample stage 202 through corresponding multiple flexure elements 201a-d in order to provide a system that can be moved simultaneously in both the X and Y directions. The Examiner has asserted that Sarkar discloses "a fast scanning stage for a scanning probe microscope" that includes a probe (Fig. 9, 901), a sample stage (202), with the stage comprising at least one fixed support (Fig. 8b, 600). The sample stage was asserted to have at least one axis of translation. See, Final Rejection, page 2.

Applicants first disagree with the Examiner's characterization of Sarkar as directed to a "fast scanning stage for a scanning probe microscope." Nowhere does Sarkar teach or suggest a "fast scanning stage," and Sarkar's purpose is to be able to produce fully decoupled movement of the microstage in both the X and Y directions simultaneously. See, Abstract and claim 1. Thus, Sarkar requires both actuators and flexure elements driven in opposition along the axis of motion. Applicants do not use flexure elements, but rather use means driven in phase and directly coupled between a fixed support and a sample stage. Further, Sarkar's microstage is designed to position a lens or mirror, as well as a disclosed embodiment using a probe. Applicants' claimed fast scanning stage is designed for providing motion along a single axis in a scanning probe microscope to complete fast scan lines which are free from turnaround artifacts.

Moreover, Sarkar's device differs in structure from applicants' claimed fast scanning stage. Claim 1 recites, *inter alia*, that the sample stage is "affixed to said at least one fixed support" by "means for causing displacement of said stage relative to said probe". Thus, for example, in the embodiment shown in Figs. 2A and 2B, sample stage 21 is fixed to supports 23 by actuators 22 which serve as the "means for causing displacement" in that embodiment. Sarkar's microstage, on the other hand, is designed to be "fully released." Applicants understand Sarkar's use of the term "fully released" to mean that the microstage is not anchored to any fixed structure, but instead is suspended from four flexure elements. For example, as shown in Fig. 2 of Sarkar, X-Y microstage 202 is suspended from flexures 201a-d. Flexures 201a-d are, in turn, connected to actuators 203a-d.

Thus, while Sarkar's microstage may be connected (indirectly through flexures) to actuator elements, there is no structure in Sarkar corresponding to the recited "at least one fixed support" of applicants' claim 1, nor to the affixation of the sample stage to such a fixed support. The Examiner in the Final Rejection asserted that structure in Sarkar corresponding to a fixed support was found in Fig. 8B, element 600. Fig. 8B depicts a "payload structure mechanically coupled to the XY stage and base structure shown in FIG. 8A" (see, col. 3, lines 66-67). Thus, as shown, base structure 600 is coupled to payload 850 by snap connectors 601. As described by Sarkar, base structure 600 includes a plurality of power pads 602, an electrostatic element 603, and feedback elements 604 --i.e., a capacitive detection substrate. Payload 850 is designed, for example, to be a lens or mirror that is coupled to the stage.

It is clear from a close reading of Sarkar, that base structure 600, while coupled (i.e., snap connected) to the microstage, is not affixed to anything except the microstage. And, flexures 201a-d and actuators 203a-d certainly do not affix the microstage to that base structure. Rather, the snap connectors 601 do. The structure of Sarkar relied upon by the Examiner in the Final Rejection is different from and does not teach or suggest applicants' claimed structure.

In the Advisory Action mailed March 31, 2006, the Examiner conceded that the Fig. 8B embodiment of Sarkar, relied upon in the Final Rejection, did not in fact teach a "fixed support." The Examiner then shifted the rejection and his reliance on Sarkar to the Fig. 10 embodiment which depicted "anchors" 1002. However, Fig. 10 of Sarkar does not depict a sample stage or how the thermal actuator shown in Fig. 10 would be attached to a sample stage, if any. The Examiner cannot use Sarkar as an encyclopedia of parts, picking and choosing elements in isolation and taken from multiple embodiments to arrive at applicants' claimed invention. Such is clearly improper.

Sarkar's previous discussion of the use of thermal actuators was with respect to Prior Art Fig. 1B. That embodiment of Sarkar has nothing to do with the movement of a scanning stage for a scanning probe microscope. Rather, it relates to the simultaneous movement of a microlens 155 in the X and Y directions. Sarkar's discussion of his Fig. 10 embodiment refers to U.S. Pat. No. 5,909,078 (col. 7, lines 10 et seq.). That patent describes a thermal actuator used to manipulate a microvalve.

The simple fact remains that none of Sarkar's embodiments includes each and every element of applicants' claim 1. Nor does the Sarkar specification describe how to combine disparate embodiments to arrive at applicants' claimed invention. The rejection of claim 1 under §102 is not well taken and should be withdrawn.

Claim 12

1. The Examiner failed to carry his burden of establishing that each and every limitation recited in the claim is found in a single prior art reference.

Anticipation under 35 USC §102(b) requires the disclosure in a single prior art reference of each element of the claims under consideration. *Alco Standard Corp. v. TVA*, 1 USPQ2d 1337, 1341 (Fed. Cir. 1986). The corollary of the rule is that absence from the reference of any

claimed element negates anticipation. *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 230 USPQ 81 (Fed. Cir. 1986).

2. Sarkar does not teach a sample stage that is affixed to at least one fixed support by at least one actuator element supporting the stage to cause displacement of the stage relative to the probe.

As discussed above, Sarkar relates to a "fully released" microstage that includes a "payload structure" such as a lens, mirror, or manipulator. The microstage is moved using actuators that are coupled to flexure elements. As shown in the embodiment in Fig. 2, Sarkar requires multiple actuators 203a-d coupled to sample stage 202 through corresponding multiple flexure elements 201a-d in order to provide a system that can be moved simultaneously in both the X and Y directions. The Examiner has asserted that Sarkar discloses "a fast scanning stage for a scanning probe microscope" that includes a probe (Fig. 9, 901), a sample stage (202), with the stage comprising at least one fixed support (Fig. 8b, 600). The sample stage was asserted to have at least one axis of translation. See, Final Rejection, page 2.

Applicants disagree with the Examiner's characterization of Sarkar as directed to a "fast scanning stage for a scanning probe microscope." Nowhere does Sarkar teach or suggest a "fast scanning stage," and Sarkar's purpose is to be able to produce fully decoupled movement of the microstage in both the X and Y directions simultaneously. See, Abstract and claim 1. Thus, Sarkar requires both actuators and flexure elements driven in opposition along the axis of motion. Applicants do not use flexure elements, but rather use actuator elements driven in phase and directly coupled between a fixed support and a sample stage. Further, Sarkar's microstage is designed to position a lens or mirror, as well as a disclosed embodiment using a probe. Applicants' claimed fast scanning stage in the scanning probe microscope is designed for providing motion along a single axis in a scanning probe microscope to complete fast scan lines which are free from turnaround artifacts.

Moreover, Sarkar's device differs in structure from applicants' claimed scanning probe microscope that includes a fast scanning stage. Claim 12 recites, *inter alia*, that the sample stage is "affixed to said at least one fixed support" by "at least one actuator element supporting said stage to cause displacement of said stage relative to said probe". Thus, for example, in the

embodiment shown in Figs. 2A and 2B, sample stage 21 is fixed to supports 23 by actuators 22 which serve as the "means for causing displacement" in that embodiment. Sarkar's microstage, on the other hand, is designed to be "fully released." Applicants understand Sarkar's use of the term "fully released" to mean that the microstage is not anchored to any fixed structure, but instead is suspended from four flexure elements. For example, as shown in Fig. 2 of Sarkar, X-Y microstage 202 is suspended from flexures 201a-d. Flexures 201a-d are, in turn, connected to actuators 203a-d.

Thus, while Sarkar's microstage may be connected (indirectly through flexures) to actuator elements, there is no structure in Sarkar corresponding to the recited "at least one fixed support" of applicants' claim 12, nor to the affixation of the sample stage to such a fixed support. The Examiner in the Final Rejection asserted that structure in Sarkar corresponding to a fixed support was found in Fig. 8B, element 600. Fig. 8B depicts a "payload structure mechanically coupled to the XY stage and base structure shown in FIG. 8A" (see, col. 3, lines 66-67). Thus, as shown, base structure 600 is coupled to payload 850 by snap connectors 601. As described by Sarkar, base structure 600 includes a plurality of power pads 602, an electrostatic element 603, and feedback elements 604 --i.e., a capacitive detection substrate. Payload 850 is designed, for example, to be a lens or mirror that is coupled to the stage.

It is clear from a close reading of Sarkar, that base structure 600, while coupled (i.e., snap connected) to the microstage, is not affixed to anything except the microstage. And, flexures 201a-d and actuators 203a-d certainly do not affix the microstage to that base structure. Rather, the snap connectors 601 do. The structure of Sarkar relied upon by the Examiner in the Final Rejection is different from and does not teach or suggest applicants' claimed structure.

In the Advisory Action mailed March 31, 2006, the Examiner conceded that the Fig. 8B embodiment of Sarkar, relied upon in the Final Rejection, did not in fact teach a "fixed support." The Examiner then shifted the rejection and his reliance on Sarkar to the Fig. 10 embodiment which depicted "anchors" 1002. However, Fig. 10 of Sarkar does not depict a sample stage or how the thermal actuator shown in Fig. 10 would be attached to a sample stage, if any. The Examiner cannot use Sarkar as an encyclopedia of parts, picking and choosing elements in isolation and taken from multiple embodiments to arrive at applicants' claimed invention. Such is clearly improper.

Sarkar's previous discussion of the use of thermal actuators was with respect to Prior Art Fig. 1B. That embodiment of Sarkar has nothing to do with the movement of a scanning stage for a scanning probe microscope. Rather, it relates to the simultaneous movement of a microlens 155 in the X and Y directions. Sarkar's discussion of his Fig. 10 embodiment refers to U.S. Pat. No. 5,909,078 (col. 7, lines 10 et seq.). That patent describes a thermal actuator used to manipulate a microvalve.

The simple fact remains that none of Sarkar's embodiments includes each and every element of applicants' claim 12. Nor does the Sarkar specification describe how to combine disparate embodiments to arrive at applicants' claimed invention. The rejection of claim 12 under §102 is not well taken and should be withdrawn.

B. The Rejection of Claims 2-6 and 13 under 35 USC §103 as unpatentable over Sarkar et al in view of Flecha et al

For this ground of rejection, claims 2-3 and 5-6 are dependent directly or indirectly on claim 1. Claim 4 is independent. Claim 13 is independent. Applicants will separately argue the patentability of these rejected claims.

Claim 2 as representative of claims 2-3 and 5-6

When obviousness is based on the teachings of multiple prior art references, the Examiner must also establish some "suggestion, teaching, or motivation" that would have led a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed. *See Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1572 (Fed. Cir. 1996); *Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 665 (Fed. Cir. 2000).

Federal Circuit case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references. *Dembiczak*, 175 F.3d at 999; *see also Ruiz*, 234 F.3d at 665. This is because "[c]ombining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability—the essence of hindsight."

Dembiczak, 175 F.3d at 999. Therefore, the Federal Circuit has consistently held that a person of ordinary skill in the art must not only have had some motivation to combine the prior art teachings, but some motivation to combine the prior art teachings in the particular manner claimed. *See, e.g., In re Kotzab*, 217 F.3d 1365, 1371 (Fed. Cir. 2000) ("Particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination *in the manner claimed.*" (emphasis added)); *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998) ("In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination *in the manner claimed*"(emphasis added)).

In the Final Rejection, the Examiner rejected claims 2-6 and 13 under 35 USC §103 as unpatentable over Sarkar in view of Flecha et al (US 5,773,824). Flecha relates to a scanning probe microscope using active lateral scanning control of the probe to achieve improved accuracy. The Examiner conceded that that Sarkar did not teach or suggest using a sine waveform generator for actuating at least one actuator element. However, the Examiner asserted that it would have been obvious to use a "sine waveform generator" as taught by Flecha "to drive the stage in order to more accurately detect the sample on the stage by varying the height with respect to the probe."

Applicants submit that the Examiner has failed to establish a prima facie case of obviousness. Sarkar has the same deficiencies as discussed in detail above with respect to the construction of its fully released flexure stage. Claims 2-3 and 5-6 depend from claim 1, which recites a structural relationship not taught or suggested by Sarkar. The Examiner has made no allegations that Flecha et al would correct these significant structural and operational deficiencies in the teachings of Sarkar.

In order to carry his burden to combine reference teachings, the Examiner must demonstrate by evidence that there is some suggestion or motivation *in the prior art* to make the proposed modifications. Here, Sarkar shows a specific arrangement of actuators, flexure elements, and a microstage such that the stage is "fully released" and can be driven simultaneously in the X and Y directions. Flecha describes a scanning probe microscope that includes a fast actuator 22 and a slow actuator 26 for Z-axis movement, and a lateral motion

actuator 16 for X-Y axis movement. As described by Flecha, the lateral motion actuator generates relative movement between a sample and a scanning probe *only* when the first drive mechanism (the fast actuator) is within a second predetermined range of movement. See, col. 4, lines 47-52.

Thus, the lateral movement actuator of Flecha is designed to be operated only under certain circumstances in conjunction with the specific fast and slow actuator mechanisms. It is apparent that Flecha's operation is very specifically tied to the combination of fast, slow, and lateral actuator mechanisms. There is nothing in Flecha or Sarkar that would motivate or suggest to one skilled in the art that Flecha's lateral motion actuator could or should be substituted into the very different structure of the fully-released microstage of Sarkar. The Examiner has provided no explanation or reasoning as to how or why such substitution should be accomplished other that making the conclusory statement that the use of such would improve accuracy. The Examiner has made no evidentiary showing that the use of Flecha's lateral motion actuator in Sarkar would have any expectation of improving accuracy in the operation of Sarkar's microstage.

Further, contrary to the Examiner's assertion, Flecha does not teach driving a sample with respect to a scanning probe using a sine waveform generator. What Flecha states is that lateral motion actuator 16 "may drive the sample 12 in x- and y-directions, which are perpendicular to one another, producing a sinusoidal or sawtooth pattern of motion." See, col. 5, lines 32-34. Thus, Flecha teaches the production of side-to-side (i.e., lateral) movement which may result in a sinusoidal or sawtooth scan. Nothing in Flecha teaches or suggests the use of or operation of a sine waveform generator in conjunction with an actuator element to produce such lateral movement.

Claim 4

Claim 4 was rejected under the same combination of Sarkar with Flecha. Claim 4 recites, *inter alia*, that "said sample stage is affixed to said at least one fixed support by at least one actuator element," that a "sinewave generator" is provided "for actuating said at least one actuator element," and that the "at least one actuator element" is "driven at a frequency of

resonant vibration corresponding to translation of said sample with respect to said probe." For the reasons discussed above, applicants submit that the Examiner has failed to establish a prima facie case of obviousness. Sarkar has the same deficiencies as discussed in detail above with respect to the construction of its fully released flexure stage. Claim 4, as does independent claim 1, recites that "said sample stage is affixed to said at least one fixed support by at least one actuator element." Thus, claim 4 recites a structural relationship not taught or suggested by Sarkar as discussed in detail with respect to the same limitation which is found in claim 1. The Examiner has made no allegations that Flecha et al would correct these significant structural and operational deficiencies in the teachings of Sarkar.

In order to carry his burden to combine reference teachings, the Examiner must demonstrate by evidence that there is some suggestion or motivation *in the prior art* to make the proposed modifications. Here, Sarkar shows a specific arrangement of actuators, flexure elements, and a microstage such that the stage is "fully released" and can be driven simultaneously in the X and Y directions. Flecha describes a scanning probe microscope that includes a fast actuator 22 and a slow actuator 26 for Z-axis movement, and a lateral motion actuator 16 for X-Y axis movement. As described by Flecha, the lateral motion actuator generates relative movement between a sample and a scanning probe *only* when the first drive mechanism (the fast actuator) is within a second predetermined range of movement. See, col. 4, lines 47-52.

Thus, the lateral movement actuator of Flecha is designed to be operated only under certain circumstances in conjunction with the specific fast and slow actuator mechanisms. It is apparent that Flecha's operation is very specifically tied to the combination of fast, slow, and lateral actuator mechanisms. There is nothing in Flecha or Sarkar that would motivate or suggest to one skilled in the art that Flecha's lateral motion actuator could or should be substituted into the very different structure of the fully-released microstage of Sarkar. The Examiner has provided no explanation or reasoning as to how or why such substitution should be accomplished other that making the conclusory statement that the use of such would improve accuracy. The Examiner has made no evidentiary showing that the use of Flecha's lateral motion actuator in Sarkar would have any expectation of improving accuracy in the operation of Sarkar's microstage.

Further, contrary to the Examiner's assertion, Flecha does not teach driving a sample with respect to a scanning probe using a sine waveform generator. What Flecha states is that lateral motion actuator 16 "may drive the sample 12 in x- and y-directions, which are perpendicular to one another, producing a sinusoidal or sawtooth pattern of motion." See, col. 5, lines 32-34. Thus, Flecha teaches the production of side-to-side (i.e., lateral) movement which may result in a sinusoidal or sawtooth scan. Nothing in Flecha teaches or suggests the use of or operation of a sine waveform generator in conjunction with an actuator element to produce such lateral movement.

Finally, with respect to claim 4, nothing in either Sarkar or Flecha teaches or suggests operation of an actuator element "driven at the frequency of resonant vibration corresponding to translation of said sample with respect to said probe. The Examiner has not even alleged that such a teaching is found in either of the applied references (and explicitly admitted that the references do not so teach later in the Final Rejection). For all of the above reasons, applicants submit that claim 4 is also patentable.

Claim 13

Claim 13 recites a method of operating a fast scanning stage for a scanning probe microscope. Claim 13 was rejected under the same combination of Sarkar with Flecha. Claim 13 recites, *inter alia*, that the sample stage is displaced relative to the probe "by actuating at least one actuator element to drive said stage at its resonant frequency using a sine waveform generator."

In order to carry his burden to combine reference teachings, the Examiner must demonstrate by evidence that there is some suggestion or motivation *in the prior art* to make the proposed modifications. Here, Sarkar shows a specific arrangement of actuators, flexure elements, and a microstage such that the stage is "fully released" and can be driven simultaneously in the X and Y directions. Flecha describes a scanning probe microscope that includes a fast actuator 22 and a slow actuator 26 for Z-axis movement, and a lateral motion actuator 16 for X-Y axis movement. As described by Flecha, the lateral motion actuator generates relative movement between a sample and a scanning probe *only* when the first drive

mechanism (the fast actuator) is within a second predetermined range of movement. See, col. 4, lines 47-52.

Thus, the lateral movement actuator of Flecha is designed to be operated only under certain circumstances in conjunction with the specific fast and slow actuator mechanisms. It is apparent that Flecha's operation is very specifically tied to the combination of fast, slow, and lateral actuator mechanisms. There is nothing in Flecha or Sarkar that would motivate or suggest to one skilled in the art that Flecha's lateral motion actuator could or should be substituted into the very different structure of the fully-released microstage of Sarkar. The Examiner has provided no explanation or reasoning as to how or why such substitution should be accomplished other that making the conclusory statement that the use of such would improve accuracy. The Examiner has made no evidentiary showing that the use of Flecha's lateral motion actuator in Sarkar would have any expectation of improving accuracy in the operation of Sarkar's microstage.

Further, contrary to the Examiner's assertion, Flecha does not teach driving a sample with respect to a scanning probe using a sine waveform generator. What Flecha states is that lateral motion actuator 16 "may drive the sample 12 in x- and y-directions, which are perpendicular to one another, producing a sinusoidal or sawtooth pattern of motion." See, col. 5, lines 32-34. Thus, Flecha teaches the production of side-to-side (i.e., lateral) movement which may result in a sinusoidal or sawtooth scan. Nothing in Flecha teaches or suggests the use of or operation of a sine waveform generator in conjunction with an actuator element to produce such lateral movement.

Finally, with respect to claim 13, nothing in either Sarkar or Flecha teaches or suggests "actuating at least one actuator element to drive said stage at its resonant frequency" The Examiner has not even alleged that such a teaching is found in either of the applied references (and explicitly admitted that the references do not so teach later in the Final Rejection). For all of the above reasons, applicants submit that claim 13 is also patentable.

C. The Rejection of Claims 4 and 13 under 35 USC §103 as Unpatentable over Sarkar in view of Flecha and Okiguchi

Claims 4 and 13 are independent. Applicants will separately argue their patentability.

Claim 4

Also in the Final Rejection, the Examiner rejected claims 4 and 13 under 35 USC §103 as unpatentable over Sarkar in view of Flecha and Okiguchi (JP 09054097). Claim 4, like claim 1, recites that that the sample stage is "affixed to said at least one fixed support." As discussed in detail above, Sarkar does not teach or suggest such a construction. The rejection is deficient for that reason and should be withdrawn. Additionally, applicants hereby repeat and incorporate by reference their arguments above with respect to the rejection of claim 4 on Sarkar in view of Flecha. The rejection is deficient for these additional reasons and should be withdrawn.

The Examiner cited Okiguchi in a vain attempt to meet the recitations of claim 4. Okiguchi relates to the use of a quartz oscillator circuit coupled to a sample stage to permit rapid movement of a probe in the Z-direction toward the surface of a sample without colliding with the sample. Okiguchi teaches nothing with respect to control of an X- or Y-axis actuator. The Examiner has provided no reasoning as to why one skilled in the art would modify Sarkar/Flecha to control Z-axis probe movement, or even if one were to do so, how such a modified device would meet the claims. As Okiguchi relates to Z-axis movement, Okiguchi fails to correct the many deficiencies of Sarkar and Flecha with respect to the claims. The rejection of claim 4 is not well taken for these additional reasons and should be withdrawn.

Claim 13

Claim 13 is directed to the method of operating the fast scanning stage. Claim 13 recites, *inter alia*, "actuating at least one actuator element to drive said stage at its resonant frequency." The Examiner cited Okiguchi in a vain attempt to meet the recitations of claim 13. Okiguchi relates to the use of a quartz oscillator circuit coupled to a sample stage to permit rapid

movement of a probe in the Z-direction toward the surface of a sample without colliding with the sample. Okiguchi teaches nothing with respect to control of an X- or Y-axis actuator. The Examiner has provided no reasoning as to why one skilled in the art would modify Sarkar/Flecha to control Z-axis probe movement, or even if one were to do so, how such a modified device would meet the claims. As Okiguchi relates to Z-axis movement, Okiguchi fails to correct the many deficiencies of Sarkar and Flecha with respect to claim 13. The rejection of claim 13 is not well taken for these additional reasons and should be withdrawn.

D. The Rejection of Claim 7 under 35 USC §103 as Unpatentable over Sarkar in view of Flecha and Pai

Also in the Final Rejection, the Examiner rejected claim 7 under 35 USC §103 as unpatentable over Sarkar in view of Flecha and Pai (US 6,338,249). Solely for purposes of simplifying an already lengthy Brief on Appeal, applicants will not separately argue the patentability of dependent claim 7 at this time. Rather, applicants will rely on their arguments for patentability, set forth in detail above, with respect to those claims from which claim 7 directly or indirectly depends.

E. The Rejection of Claim 8 under 35 USC §103 as Unpatentable over Sarkar in view of Flecha and Elings

Also in the Final Rejection, the Examiner r rejected claim 8 under 35 USC §103 as unpatentable over Sarkar in view of Flecha and Elings (US RE 37,560). Solely for purposes of simplifying an already lengthy Brief on Appeal, applicants will not separately argue the patentability of dependent claim 8 at this time. Rather, applicants will rely on their arguments for patentability, set forth in detail above, with respect to those claims from which claim 8 directly or indirectly depends.

F. The Rejection of Claims 9 and 10 under 35 USC §103 as Unpatentable over Sarkar in view of Flecha and Zdeblick

Also in the Final Rejection, the Examiner rejected claims 9 and 10 under 35 USC §103 as unpatentable over Sarkar in view of Flecha and Zdeblick (US 4,906,840). Solely for purposes of

simplifying an already lengthy Brief on Appeal, applicants will not separately argue the patentability of dependent claims 9 and 10 at this time. Rather, applicants will rely on their arguments for patentability, set forth in detail above, with respect to those claims from which claims 9 and 10 directly or indirectly depend.

G. The Rejection of Claim 11 under 35 USC §103 as Unpatentable over Sarkar in view of Marchman

Also in the Final Rejection, the Examiner rejected claim 11 under 35 USC §103 as unpatentable over Sarkar in view of Marchman (US 5,811,796). Solely for purposes of simplifying an already lengthy Brief on Appeal, applicants will not separately argue the patentability of dependent claim 11 at this time. Rather, applicants will rely on their arguments for patentability, set forth in detail above, with respect to those claims from which claim 11 directly or indirectly depends.

H. The Rejection of Claim 15 under 35 USC §103 as Unpatentable over Sarkar in view of Flecha, Okiguchi, and Ando et al.

Also in the Final Rejection, the Examiner rejected claim 15 under 35 USC §103 as unpatentable over Sarkar in view of Flecha, Okiguchi, and Ando et al. Solely for purposes of simplifying an already lengthy Brief on Appeal, applicants will not separately argue the patentability of dependent claim 15 at this time. Rather, applicants will rely on their arguments for patentability, set forth in detail above, with respect to those claims from which claim 15 directly or indirectly depends.

Conclusion

For all of the above reasons, applicants submit that the rejections for review on appeal are not well taken, are based on factual and/or legal errors and omissions, and should be reversed in their entireties.

Respectfully submitted,

DINSMORE & SHOHL LLP

By ______________________

Timothy W. Hagan
Registration No. 29,001

One Dayton Centre
One South Main Street, Suite 1300
Dayton, Ohio 45402-2023
(937) 449-6400
Facsimile: (937) 449-6405
E-mail: tim.hagan@dinslaw.com

CLAIMS APPENDIX

1. A fast scanning stage for a scanning probe microscope, said scanning probe microscope including a probe, said stage comprising, at least one fixed support, and a sample stage having at least one axis of translation, said sample stage being affixed to said at least one fixed support by means for causing displacement of said stage relative to said probe.

2. A fast scanning stage as claimed in claim 1 in which said means for causing displacement of said sample comprise at least one actuator element supporting said stage and a sine waveform generator for actuating said at least one actuator element.

3. A fast scanning stage as claimed in claim 2 in which said means for causing displacement of said sample stage comprise four actuator elements supporting said stage.

4. A fast scanning stage for a scanning probe microscope, said scanning probe microscope including a probe, said fast scanning stage comprising at least one fixed support and a sample stage having at least one axis of translation, said sample stage being affixed to said at least one fixed support by at least one actuator element, a sine waveform generator for actuating said at least one actuator element, in which said stage is displaced by said at least one actuator element being driven at the frequency of resonant vibration corresponding to translation of said sample with respect to said probe.

5. A fast scanning stage as claimed in claim 3 in which said stage has a square or rectangular configuration and each corner of said stage is supported by one of said actuator elements.

6. A fast scanning stage as claimed in claim 5 in which said actuator elements form a parallelogram scanning element.

7. A fast scanning stage as claimed in claim 6 in which said actuator elements are connected electrically in parallel.

8. A fast scanning stage as claimed in claim 2 in which said at least one actuator element comprises a stack bending element.

9. A fast-axis scanning stage as claimed in claim 2 in which said at least one actuator element comprises a PZT bimorph.

10. A fast-axis scanning stage as claimed in claim 3 in which said at least one actuator element comprises a PZT bimorph.

11. A fast-axis scanning stage as claimed in claim 1 in which said stage is comprised of a material selected from the group consisting of ceramics, heat resistant polymers, and anodized aluminum.

12. A scanning probe microscope including a probe and a fast scanning stage, said fast scanning stage comprising at least one fixed support, and a sample stage having at least one axis of translation, said sample stage being affixed to said at least one fixed support by at least one actuator element supporting said stage to cause displacement of said stage relative to said probe.

13. A method of operating a fast scanning stage for a scanning probe microscope, said scanning probe microscope including a probe, comprising, providing a sample stage having a sample thereon and causing displacement of said stage relative to said probe by actuating at least one actuator element to drive said stage at its resonant frequency using a sine waveform generator.

14. Canceled.

15. A method as claimed in claim 13 in which the resonant frequency of said stage is about $1/100^{th}$ that of the resonant frequency of said probe.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.